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ABSTRACT

In April 1994, New York City Technical College established the Mathematics Task Force to review mathematics instruction at the college and recommend policy and program changes. The Task Force established three sub-committees: (1) a Curriculum and Instruction Sub-Committee to survey mathematics faculty regarding instructional techniques, (2) an Inter-Departmental Mechanisms Committee to survey all academic departments at the college regarding coordination with the mathematics department, and (3) a Students Sub-Committee to hold focus groups with mathematics students. The faculty survey received responses from 42 of the college's 58 full- and part-time faculty and indicated that faculty believed that student learning was enhanced by including applications in classroom activities, encouraging students to take courses in sequences, and using tutors and workshops. Although 70% of the programs surveyed by the Mechanisms Sub-Committee were satisfied with their current situation, career departments did express concerns related to the need to emphasize mathematics applications and encourage joint faculty appointments in mathematics and career programs. Finally, responses from student focus groups highlighted the importance of caring and supportive faculty, instructor encouragement of student questions, and well-paced and systematic instructor presentations. Includes 13 recommendations for improving the program related to mathematics curriculum and instruction, successful student and instructor behaviors, and interdepartmental and college-wide coordination. The task force appointment letter and the three Sub-Committees' final reports are appended. (TGI)

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ED 396 776

REPORT

OF THE

MATHEMATICS TASK FORCE

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MAY, 1995

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New York City
Technical College
The City University of New York

Inter-Office Memorandum

To: Provost Emilie Cozzi

From: David Entin, Chair DE

Subj: Mathematics Task Force Report

Date: June 1, 1995

I am pleased to present the final report of the Mathematics Task Force, which you appointed in April, 1994. The Task Force has spent the past year diligently pursuing the charge contained in the original appointment letter. The Task Force met monthly throughout the academic year and this spring divided into sub-committees which met frequently.

I want to personally thank all the members of the Task Force for their efforts and commitment. The College is indebted to them for their contributions and the results contained in the final report. I am particularly grateful to Profs. Rhona Noll and Arthur Kramer for their leadership roles in chairing two of the sub-committees and to Higher Education Officer Onofrio Gaglione for assisting me in facilitating the work of the Task Force. The members worked very well together and were unanimous in support of the final report and recommendations.

The Task Force believes that implementation of the recommendations for action will enhance the value and effectiveness of mathematics education at City Tech. We urge a careful reading of this report by all City Tech Department Chairs and all mathematics faculty and consideration of the best means to carry out the suggestions contained in the report. This report should be widely circulated among the College community. Thank you for this opportunity to serve.

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MATHEMATICS TASK FORCE REPORT

TABLE OF CONTENTS

Transmittal Memorandum	i
Table of Contents	ii
Task Force Membership	iii
I. Background	1
II. Curriculum and Instruction	3
III. Interdepartmental Mechanisms	7
IV. Student Focus Groups	8
V. Recommendations	10
Appendices	iv

MATHEMATICS TASK FORCE

DAVID ENTIN, CHAIR

Members	Department
Robert Cermele	Developmental Skills
Alan Damon	Art & Advertising
Thomas Fabricante	Developmental Mathematics
Onofrio Gaglione	Arts and Sciences
Joel Greenstein	Mathematics
Abe Korn	Physics
Arthur Kramer	Mathematics
Ellen McGuinn	Nursing
Aisha Moody	Legal Assistant Studies(student)
Rhona Noll	Developmental Mathematics
Estella Rojas	Mathematics
Linda Silverman	Continuing Education
Neil Witherspoon	Electromechanical Engineering
Richard Woytowich	Mechanical Engineering Technology

MATHEMATICS TASK FORCE

APPENDICES

APPENDIX A	Task Force Appointment Letter
APPENDIX B	Faculty Survey and Individual Responses
APPENDIX C	Report of the Subcommittee on Curriculum and Instruction
APPENDIX D	Student Focus Group Write-Up's
APPENDIX E	Report on Student Focus Groups
APPENDIX F	Report of the Sub-Committee on Interdepartmental Mechanisms
APPENDIX G	Sub-Committee Action Plans
APPENDIX H	Detailed Results of Mathematics Faculty Questionnaire
APPENDIX I	Other City Tech Reports/Internal Documents Received/Collected by Task Force
APPENDIX J	Literature distributed to the Task Force
APPENDIX K	Appendix I, II, and III from Literature Search on State-of-the Art and IV Course Equivalency Guide

Note: This edition is an abreviated version and contains only Appendices A, C, E, and F. For a copy with all the appendices see the Library, Mathematics Department Office, or Dean of Arts and Sciences' office.

MATHEMATICS TASK FORCE REPORT

I. BACKGROUND

In April, 1994, at the request of President Charles Merideth, Provost Emilie Cozzi appointed the fifteen-member Mathematics Task Force to review the teaching of mathematics at New York City Technical College and recommend policy and program changes for improvements in mathematics instruction (See Appendix A for original appointment letter). The Task Force included eleven faculty (three in Developmental Mathematics and three in Mathematics), two students, one staff, and one administrator. Dean David Entin was asked to chair the Task Force. Professor Onofrio Gaglione agreed to serve as Task Force secretary and staff. Charges to the Task Force included study of the curriculum and pedagogy employed in mathematics at City Tech and elsewhere, surveying student and alumni views on mathematics instruction, and recommendations for teaching approaches to enhance student learning in mathematics and ways to better integrate mathematics into the overall curriculum of the college.

The Task Force held its organizational meeting on May 18, 1994. It met monthly throughout the 1994-95 academic year. The Task Force decided first to hear from the Engineering Technology, Business, and Health divisions in the college. In September, 1994, the Task Force met with the acting chair of the Mathematics Department to gain a better understanding of the current curriculum

offerings in Mathematics. In October, Dean Manello and three faculty from the Division of Engineering Technology accepted the Task Force invitation to present their ideas about the teaching of mathematics at City Tech and the mathematics needs of engineering technology students. In November, three faculty from the divisions of business and health, along with Dean Gerald Griffin, presented their concerns and suggestions. For the December meeting Professor Mark Elkins of Electromechanical Technology and Professor Henry Africk, Acting Chair of Mathematics, discussed a current problem representing the mathematics instructional needs for engineering students. In addition, President Charles Merideth shared his ideas at the December meeting.

In the Spring 1995, the Task Force also met monthly, but divided into three sub-committees, Curriculum and Instruction, Students, and Inter-Departmental Communications, chaired respectively by Prof. Rhona Noll, Dean David Entin, and Prof. Arthur Kramer. The three sub-committees met between full Task Force meetings, conducted research in their respective areas, and presented reports on their findings to the Task Force. The Curriculum and Instruction Sub-Committee surveyed full and part-time faculty teaching mathematics courses and conducted a literature search on current and innovative teaching methods in mathematics. (See Appendix B for the faculty survey and Appendix J for information on state-of-the-art.)

The Students Sub-Committee conducted seven focus groups of current students at all levels of mathematics and various majors. The focus groups ranged in size from six to twenty students, and lasted from forty-five minutes to one hour (See Appendix D for the write-up's of the seven focus groups). The Inter-Departmental Mechanisms Committee surveyed all academic departments regarding their current mechanisms for coordinating with the mathematics department and suggestions for improvement, as well as transfer articulation (See Appendix F). Unfortunately the institution was unable to provide results from the alumni survey or requests for institutional research data in time for completion of the Task Force's work. On April 13, the Task Force approved the three reports, which form the basis of this final report, and asked the sub-committees to develop an action plan to carry out proposed recommendations. At its final meeting on May 11, 1995, the Task Force discussed and adopted thirteen recommendations for action (See Section V. below).

II. CURRICULUM AND INSTRUCTION

The Mathematics Department at City Tech offers two sequences for students at the college who pursue one of its associate or baccalaureate degree programs. The first sequence is the following traditional set of mathematics courses:

MA175 (Algebra I part 2 and Geometry)
MA275 (Algebra II and Trigonometry)
MA375 (Algebra III/Pre-Calculus)
MA475 575, 675 (Calculus I, II, III)
MA680 (Differential Equations)
MA430 (Numerical Methods)
MA440 (Discrete Mathematics).

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The last two courses listed above are offered primarily to students majoring in the AS program in Computer Science.

The other sequence is the MA180-280 courses which are broader in scope but more shallow in depth of content than the first two courses (MA175-275) of the first sequence. MA180-280 is designed for students in disciplines that do not require preparation for pre-calculus or calculus. The department also offers two statistics courses (MA172 and MA372).

The college's decision to require an AAS/Baccalaureate Core Curriculum that may be satisfied by either MA275 or MA280 depending on the student's major, has positively impacted on the department's offering. Students in certain disciplines may not have to choose a math course in the calculus sequence in order to satisfy the core.

At the present time experiments that may improve the delivery of instruction, are being implemented and explored. Since 1993 selected sections of MA375 and MA475 have been restructured to include a workshop section run by peer tutors and supervised by faculty in a collaborative learning project funded by the National Science Foundation (NSF) via the CUNY Alliance for Minority Participation (AMP) Program. The inclusion of graphing calculators in mathematics curricula is a component of this experiment and support from AMP has enabled the department to provide faculty, peer tutors and students in a selected section with their own calculator during the workshop session. The department also hopes

to experiment with materials developed by the Academic Systems Corporation in the Fall, 1995 semester. The Task Force's major concern with these projects is whether fiscal stringencies at the present time will prevent the institutionalization of these innovative methods once the external funding runs out.

In addition to the department's search to implement modern techniques in methodology and pedagogy, it must also insure that the content of each course is appropriate for the needs of students in each associate degree discipline and for those who will be pursuing the baccalaureate degree either at City Tech or some other senior college. The Task Force consulted the 1995 CUNY Equivalency Guide and concluded that all mathematics courses offered at City Tech are also offered at all the other four year colleges of CUNY.

In order to collect the information for a detailed report on the department's pedagogical innovations, the Task Force distributed, collected and analyzed the results of a survey in which full and part time faculty of the Mathematics Department were asked to respond to questions on collaborative learning, peer tutoring, use of technology, writing in mathematics, etc. (a copy of the survey appears in Appendix B).

The response rate for this survey was 72% and included 100% of the full-time faculty and 62% of the part-time faculty, yielding a total sample of 42 out of a possible 58. The faculty in this sample have an average of 21.2 years of experience in teaching mathematics and indicate that they believe that student

preparedness, methodology, curriculum and class size were the most important factors in the enhancement of student learning of mathematics. Textbooks, supplies/equipment and computer support were considered to be of lesser importance. The surveys also showed that student learning is enhanced by

* including applications in the classroom activities.
* encouraging students to take math in sequence without gaps.
* tutors, workshops and problem solving sessions.
* student attitudes that take math seriously.
* improving note-taking skills of students.
* students arriving on time to class.
* increased reading of the textbook.

The Subcommittee on Curriculum and Instruction that was responsible for conducting and analyzing the data from the survey, concluded that the mathematics department was in the "mainstream of experimentation and innovation, although its success could be enhanced by a more thoroughly structured process." (The report of the Subcommittee on Curriculum and Instruction appears in Appendix C).

The meetings of the Task Force also raised the issue of whether mathematics courses should aim primarily at those skills required in career program disciplines, in contrast to a delivery of instruction that is based on the development of "critical

thinking skills." The next section of this report will describe the Task Force's findings in this area.

III. INTERDEPARTMENTAL MECHANISMS

In an attempt to review and recommend the most effective mechanism to ensure on an ongoing basis that the mathematics courses reflect the needs of students in academic programs and employers of City Tech graduates, the Task Force invited members of faculty and administration to address this issue at one of its meetings. In addition the Subcommittee on Interdepartmental Mechanisms surveyed the mathematics department and each academic department that it serves, regarding formal and informal mechanisms that communicate to the math faculty the mathematical needs of students in career programs.

The meetings of the Task Force produced the following list of concerns that were expressed by career department faculty and administrators:

(1) applications should be stressed via work problems and the development of physical constructs.

(2) joint faculty appointments in math and certain career programs should be encouraged.

(3) calculus should not be taught at the associate degree level.

(4) dedicated sections for career students are efficient in teaching applications but are impractical under conditions of fiscal stringency.

(5) the college is moving toward the development of more baccalaureate degree programs and therefore the Mathematics Department should stress critical thinking skills so that career students develop a technologist

mind-set rather than one of a technician.

(6) health and business majors appear to lack sufficient background in such content areas as fractions, ratios, proportions, three-dimensional geometric concepts, basic statistics, bio-statistics, probability and dimensional analysis.

The report of the subcommittee on interdepartmental communications found that no formal mechanism exists for communications or coordination between an academic program and the mathematics department. Some informal articulation appears to occur between departments in the Division of Technology and the Mathematics Department, and there is one example of a mathematics faculty member, Professor Arthur Kramer, teaching courses in Electro-Mechanical Technology.

While 70% of the programs surveyed expressed satisfaction with the present situation (see survey summary in Appendix F), there does appear to be sufficient reason to formalize a mechanism in which career programs communicate their needs for changes in the mathematics curriculum. The Task Force recommends that a mathematics faculty member be appointed to act as a liaison with each division. This individual can schedule regular meetings with each program and report back to the department any concerns and recommendations for change.

IV. STUDENT FOCUS GROUPS

In an attempt to record and report the views, experiences, concerns and recommendations of City Tech students regarding the mathematics curriculum and instruction, the Task Force conducted

seven focus groups (a report of the findings appears in Appendix E).

The following is a list of student observations that are directed at Mathematics faculty to enhance learning:

(1) Caring and supportive instructors make students feel comfortable in class and reduce "math phobia" among students.

(2) Instructors should encourage students to ask any and all questions in class and to solve problems on the chalk board during class times.

(3) Instructor presentation should be both appropriately paced and systematic, including explanations of operations and alternative methods for solving problems.

(4) Instructors should assess student needs via pre-test, diagnostic instruments and surveys.

(5) Instructors should use real world examples, applications and types of problems related to career aspirations of the students in the class.

(6) Homework should be assigned each week, collected, corrected and returned in a timely fashion.

(7) Instructors should encourage students to come to their office during their scheduled office hours or by appointment to receive individual assistance when the material is not clear to the student and additional explanation is needed.

(8) Instructors should assist students in the formation of study groups, promote good study habits and time management, and in lower level courses address the problem of math phobia.

(9) Instructors should explain the value of mathematics as a foundation for science, technology, logical thinking and problem solving.

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V. RECOMMENDATIONS

The Task Force developed numerous ideas for implementation by both the Mathematics Department and the College as a whole. Each Sub-Committee proposed a suggested action plan (See Appendix G). The Task Force recommends that the entire faculty of the Mathematics Department carefully review this report and consider means to implement the various suggestions for change and improvement. In addition, the Task Force believes that the promotion of quantitative reasoning and computational skills are not the exclusive province of the Mathematics Department, but the responsibility of all academic departments and programs. For this reason, there are also specific recommendations for the College, and this report should be disseminated to all departments and divisions. To aid the College and the Mathematics Department in consideration of this report the following specific recommendations have been developed:

A. Mathematics Curriculum and Instruction

1. Professional Development: It is suggested that during the Fall 1995 semester, the Math Department circulate a questionnaire to all full-time and adjunct personnel regarding workshops and in-service seminars. Specifically the questions can address: topics, optimum time for holding the seminars, and the number of sessions the faculty would be interested in attending. Then, during the semester a committee can be formed to plan and develop the workshops and an appropriate assessment instrument.

Funding/administrative support will also need to be investigated so that, where applicable, outside speakers can be hired and needed materials can be purchased. It is suggested that the Spring 1996 semester would be an optimum time for running the workshops.

2. Curriculum: It is suggested that during the Fall 1995 semster, the Math Department curriculum committee begin to consider the issues raised in this report and the best methods of addressing them.

3. Applications: It is believed that increased employment of real world applications in the classroom will enhance mathematics instruction. All career and technical departments and programs are asked to prepare and present to the Mathematics Department a number of real world applications that can be selected for use in appropriate mathematics courses.

4. Gaps in Mathematics Instruction: The Mathematics Department is encouraged to develop and distribute an Advisement Alert by October, 1995 for all faculty advisors urging students to take their mathematics courses consecutively each semester until completing their mathematics requirements, i.e., to avoid semester gaps which hinder progress and mastery of mathematics. This information should be incorporated into the "Student Tipster" and the College Catalog.

5. Textbooks and Support: Mathematics instructors, full and part-time, are encouraged to apprise their students of the importance of utilizing textbooks and academic support resources.

Students should purchase their own textbooks required for the course at the very beginning of the semester. In case there is a delay, students should be informed of the availability of some textbooks in the library and the Learning Center for the first few weeks of the semester. The Learning Center should open earlier in the semester to meet student needs for tutoring and instructional software support.

6. Class Size: The Mathematics Department is encouraged to conduct research on the effect of class size on student learning, including requesting sections with smaller sizes when the budget permits. This will allow for the development of a statistically controlled experiment.

7. Peer Tutor Assistance: The Mathematics Department's experiments with student/peer tutors seem to have produced a positive impact on student success. Some method of institutionalizing this program should be explored. For example, the Mathematics Department might consider working with the Task Force on Internships to establish some form of incentive for high performing students to volunteer as peer tutors, i.e., perhaps some credit could be given for performing a minimum number of hours of peer tutoring.

B. Student Effort and Sensitivities

8. Successful Student Behaviors: Mathematics instructors beginning in the Fall 1995 semester should hand out, explain, and stress to students the list of behaviors of students who succeed in

mathematics. It is suggested that students discuss these behaviors in groups the first day of class and that these behaviors for academic success be reinforced throughout the semester.

9. Effective Instructor Behaviors: Mathematics faculty are encouraged individually to consider adopting the specific instructor behaviors important to enhancing classroom teaching and student learning. Individual faculty might find it helpful to complete for themselves a questionnaire on the extent to which they are employing each specific recommendation and develop an individual plan for implementation. The Department professional development committee (See Recommendation 1. above) should consider these recommended instructor behaviors in planning faculty development activities and seminars.

C. Inter-departmental and College-wide Coordination

10. Mathematics Department Liaisons: The Mathematics Department ought to appoint four faculty as liaisons to the four other academic divisions. The liaisons should meet annually with these divisions to ensure that the mathematics curricula reflect the mathematics need of the various academic programs of the College. The liaisons should bring back to the Mathematics Department recommendations and suggestions from the divisions.

11. Academic Department Liaisons: Each Department is encouraged to appoint a liaison to the Mathematics Department, which in turn should convene (at least annually) a seminar on the importance of mathematics education for all students and how

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mathematics is utilized in all career and technical fields. The liaisons from the Mathematics Department and from the other academic departments as a group can be constituted as the Mathematics Across the Curriculum Committee.

12. Annual Forum on Mathematics: The Mathematics Department convene annually a forum for all departments, and especially the departmental liaisons to Mathematics, to discuss and emphasize the importance of computational skills and quantitative reasoning by all students and the relation of mathematics instruction and learning objectives to all academic departments and programs.

D. Follow-up

13. Annual Report: The Mathematics Department is asked to include in its annual reports for 1996 and 1997 progress in implementing the various recommendations of this report.

New York City
Technical College
The City University of New York

Office of the President and Vice President
for Academic Affairs

Mr. Claude Singh
147-76 Huxley St.
Queens, NY 11422

April 18, 1994

Dear Ms. Singh

As City Tech continues to face the challenges of preparing qualified students for a national work force, a reexamination of its academic programs and support services is necessary to determine how the demands of a diverse student population can best be addressed.

In the Fall 1992 the college embarked on a self assessment of its curricular offerings and academic support services. This undertaking resulted in the development of the college's Strategic Plan which calls for enhancing the college's programs in the sciences and mathematics so that City Tech can play a leadership role in science and mathematics education.

To ensure that students receive maximum benefits from existing mathematics degree programs and mentoring and research programs, I have selected you to join the Mathematics Task Force. Specifically, the Mathematics Task Force is charged with the following:

1. Gathering necessary data on current curricular practices in the content and delivery of mathematics instruction at New York City Technical College

2. Studying ways that the pedagogy of mathematics has changed and comparing this data with current practice in similar technical institutions nation wide

3. Surveying student and alumni views regarding the mathematics education at NYCTC

4. Recommending innovative approaches to mathematics pedagogy (e.g. computer-assisted instruction, interdisciplinary courses, modular sequencing, etc.) that would enhance student learning and the integration of mathematics into the overall curriculum of the college

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5. Others as determined by the Task Force.

6. Providing a suggested timetable of activities for implementing task force recommendations.

The task force will present its recommendations in a report at the end of the Fall 1994 semester.

Both President Merideth and I feel confident that your expertise and contributions to the work of the Mathematics Task Force will result in the identification of very progressive initiatives for our City Tech students.

Sincerely
Emilie A. Cozzi
Emilie A. Cozzi
Provost

c/ file

REPORT OF THE MATH TASK FORCE SUBCOMMITTEE ON CURRICULUM AND INSTRUCTION

athematics Task Force Subcommittee on Curriculum
s: 1) literature review, 2) subcommittee discussions,
y Guide, 4) interview of the Acting Mathematics
rculation, and data analysis of an in-house

bcommittee was to investigate the nature and extent of
ssistance of Research Librarian, Bonnie Hack, a data
areas of college mathematics – content, methodology,
results of these efforts. In addition, since various
bers of national collegiate mathematics organizations,
ns were also reviewed (Appendix III).

o address the issues of innovative and effective
imented with throughout the country. These techniques
ractices at New York City Technical College. It should
ts to be experimenting with interactive computer
ed by Academic Systems Corporation, during the Fall
to point out, however, that the use of computers
institution (in terms of money, training, time for the
stem, and technical support).

y Guide (Appendix IV) was recently circulated to all
to compare New York City Tech's curriculum offerings
s. The subcommittee's analysis showed that all
City Tech are uniformly offered at **all** the other four-
ransferability of our courses is assured. The courses
for an institution offering baccalaureate degrees. The
calaureate CORE curriculum has positively impacted
of a new course with a broader array of topics.

Africk, the Acting Chair of the Mathematics
f the subcommittee members. Dr. Africk voiced
at are anticipated in the immediate future. Not only did
ties of teaching larger mathematics classes, but he also
e classroom actually involves larger time commitments
eded to teach students – it is not a time saver). He also
ed by merely sending students to work on computer

committee's work revolved around the development,
e results of a formal survey given to all full- and part-
ent (Appendix V). It is interesting to note that the
hundred percent of full-time faculty (16 out of 16) and
esponded to the questionnaire.

queried on four main categories of pedagogical
e learning, 2) tutors/peer tutors (with or without the
including graphing calculators, computers, and videos,
e also asked about class sizes; changes in their teaching
training; suggestions they give to students for
n-effective methods of enhancing learning; changes
and the importance of various items to the enhancement

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On the basis of the faculty feedback, the subcommittee found:

1) The faculty are extremely experienced, with an average (mean) of 21.2 years of math teaching (full-time = 25.8 years; part-time = 18.3 years).

2) The faculty consider the optimal class size to be 26 students (full-time = 25.3; part-time = 25.7).

3) Both full- and part-time faculty are aware of innovations in mathematics pedagogy, although not everyone has experimented with these techniques [19 people (45%) responded that they spend part of each class with small groups; 15 (36%) said they use writing; 7 (17%) said they use tutors; 10 (24%) use graphing calculators; 5 (12%) use computers in the classroom; and 12 (29%) specified they include applications]. Thirty-four of 42 people (81%), use one or more forms of the innovative techniques listed, in their teaching. From the data, it appears that full-time faculty tend to do more with small groups, tutoring, graphing calculators, computers, and the math lab.

4) Some faculty responded that with training they would do less lecturing and more with innovations – assuming class size did not increase. Both full- and part-time faculty would use more group work and computers in the classroom. Full-time faculty were also interested in using graphing calculators more extensively.

5) It appears that faculty in lower level courses, on average, spend more time on lectures; whereas the higher the level of the course, the more innovation and experimentation that are done.

6) If class sizes were optimal, respondents said they would do more small group work, more discovery learning, and less lecturing. More time would also be spent on individual problem solving and the use of tutors.

7) Larger class sizes will negatively impact on innovation and experimentation, according to the survey results. Respondents noted that more or total class time would be spent on lectures, fewer exams would be given, and short answer type tests would be used, if class sizes were to increase. Data, which has already been collected at the college, points to a decrease in the student success rate with larger class sizes.

8) Faculty considered the following items important for student success: taking math seriously; note taking skills; class participation; doing homework regularly; arriving on time to class; reading the textbook; forming study groups; and seeking tutoring as early as possible.

9) There was interest by some faculty in in-service workshops or seminars on implementing innovative techniques such as small groups and the use of technology (graphing calculators and computers).

10) Some faculty indicated that they would like to see more integration and sequencing of topics, more "hands-on" and applications, and a greater use of technology in the curriculum. They also indicated that rote learning needs to be de-emphasized in order to improve problem solving ability and the understanding of concepts. They were interested in seeing a greater, more effective use of student tutors in class, computer labs, and the Learning Center.

11) Asked about effective teaching methods, faculty responded with such items as: peer tutors, small groups, and the active participation of students.

12) On the basis of the research conducted, the subcommittee asserts that pedagogical use of technology should not be viewed as a panacea. Students on their own, even in higher level courses, need faculty input, supervision/consultation, and assistance regularly.

13) One faculty member indicated that the math lab computers were not an effective method for enhancing student learning because of improper software and the level of student preparation.

14) In response to a request to rank order [on a scale of 1 (highest) to 8 (lowest)] the importance of each of the items below to the enhancement of student learning, the faculty indicated the following:

Student preparedness	($\mu = 1.96$)
Methodology	($\mu = 2.43$)
Class Size	($\mu = 3.03$)
Curriculum	($\mu = 3.06$)
Textbook	($\mu = 4.2$)
Supplies/Equipment	($\mu = 5.54$)
Other	($\mu = 5.55$)
Computer Support	($\mu = 5.97$)

15) Faculty, generally, felt that student learning is enhanced with reasonable class size, by having students work problems – alone and together, and by the inclusion of applications.

16) The following additional remarks, included on the questionnaires, were considered noteworthy and are, therefore, presented separately:

a) Encourage students to take math in sequence, without gaps.

b) Books and tutors need to be available for students from the very beginning of the semester.

c) Any student who needed more than one semester to complete DM065, or anyone who is repeating MA175, should be required to take a workshop which would parallel the course and be a co-requisite to the course.

The Mathematics Department of New York City Technical College is definitely in the mainstream of experimentation and innovation, although its success could be enhanced and nurtured by a more thoroughly structured process. One recommendation, therefore, is that a plan of action be developed and implemented so that experimentation occurs in a structured, formal manner, rather than on an ad hoc basis. Additionally, the college needs to make a strong commitment to fostering such experimentation, in terms of time, money, training, and technical support. If such a commitment is not forthcoming, the chances of success will be minimal.

Another major recommendation by this subcommittee is that if the college wants to see a large proportion of students advance into upper level mathematics courses, then it is imperative that the students be in an environment in which they will have a chance to succeed. This implies that class size must not be increased to the point that faculty cannot provide instruction beyond the lecture mode. The students will not be served by instruction that does not take into account, the opportunities to participate, to think, and to interact with both the instructor and other students.

Respectfully submitted,

RHONA S. NOLL, Co-Chair
ROBERT CERMELE
THOMAS FABBRICANTE
JOEL GREENSTEIN
ABRAHAM KORN

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MATHEMATICS TASK FORCE: REPORT ON STUDENT FOCUS GROUPS

4/4/95 From the Student Focus Group Sub-Committee (David Entin, Chair, Alan Damon, Estela Rojas, Linda Silverman)

I. INTRODUCTION

The Student Focus Group Sub-Committee of the Mathematics Task Force conducted six focus groups of City Tech students to ask about the students' experiences with mathematics. The six groups were with the following particular and diverse audiences: SEEK students, art and advertising design, health students (nursing and dental hygiene) and third semester classes of environmental control, architectural technology and mechanical engineering technology students. The groups ranged from six to over twenty students each. The first three groups named had taken the lower level mathematics courses while the technology students had experiences with middle and upper level mathematics courses. In addition to their personal experiences with mathematics at City Tech, all students were asked about what worked for them, what was difficult about mathematics for them, how they studied and learned mathematics, and what suggestions they had for change or improvement in mathematics instruction. In all cases students were willing and sometimes even eager to talk and appreciated having an opportunity to provide input. The four member Sub-Committee divided and rotated the tasks and in each group one person served as a facilitator and another as recorder. The scribe prepared a write-up of each focus group. Below is a narrative interpretation of the results of these focus groups.

II. TEACHER CHARACTERISTICS

Most students, regardless of the level of mathematics achieved, felt that the "attitude" of the mathematics instructor was important for their learning. By attitude, students mentioned the following perceived characteristics: cheerful, caring, encouraging, and committed, to use their terms. The students reported they are more likely to ask questions and thus be engaged in the learning process when the teacher seems to encourage them. Patience was another "attitude" mentioned by students. By this students meant willingness to answer questions about the same point or problem more than twice. One final area was coming to the students' "level." This was defined as not just teaching to the top 10% of the class.

III. EFFECTIVE INSTRUCTION

Students were asked the characteristics of instruction that make for effective learning. All groups of students answered: clear and detailed explanations. Effective instructors go over each problem step by step, explaining <u>why</u> as well as how each part of

the process is done. Explanation is thus not rote, but for real understanding. Effective instruction answers the questions, "What does it mean," and "What is the point?" Effective teachers also think out in advance all the steps in problems to be presented to the class.

The biggest complaint of students at all levels was instructors going over mathematics material too quickly. When this occurs, students feel lost and confused, and think the professor only wants to get through material rather than achieve true student learning.

Students recommend that mathematics teachers move from theory to applications. They stressed relating problems to the "real world." By this students meant showing applications relevant to their lives and career courses. The final suggestion mentioned by several students was for faculty to spend some time determining the needs of a particular class. They suggested pre-tests and use of diagnostic instruments to ascertain where a class is in its learning of mathematics.

IV. STUDENT EFFORT

Students agreed that their effort is what makes the difference between success and failure in mathematics classes. Students must do assigned homework: practice is an important aid to learning. They also strongly recommend that students ask questions in class when they are unsure of or confused about material. Most students do not visit faculty during their office hours. Those who do usually complain about grades, students report, while only a few approach teachers in their offices to ask questions about course material.

How many hours per week do students study mathematics outside of class? Lower level (developmental and MA175) and less successful students usually stated two to three hours per week. Upper level and more successful students most commonly mentioned four to five hours per week. A couple said they put in ten to twelve hours prior to mathematics examinations. Effective time management was considered necessary for mathematics learning.

V. LEARNING METHODS

Students reported that the primary learning modes were listening to teachers in class and doing homework assignments alone outside of class. They said they feel more engaged and learn more when they ask questions and participate in class discussion.

A distinct minority of students did take advantage of the learning center, primarily using tutors. A few who had employed available mathematics software reported favorably on the experience. Most students had no experience with peer study groups in mathematics, but the few who did found it quite helpful. They said that they learn from the varied "angles" and approaches of their colleagues' explanations.

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VI. HELPFUL TO LEARNING

Assigned homework is considered very helpful to learning. But students want feedback and correcting from instructors. Reviewing homework in class clearly aids learning, as is asking students to put homework problems on the chalk board. One group of students found ten mathematical problems of a similar or identical type conducive to learning, but reported that assigning twenty such problems became too repetitious and thus boring.

Students considered textbooks efficacious, particularly for showing other approaches to solving a problem. Students recommended that faculty point out alternative methods for solving a particular kind of problem. They also liked study guides.

Students found smaller classes conducive for learning. They also said that students should be encouraged to do more work on their own. Teachers should intervene only when requested by students.

VII. SUGGESTIONS FOR IMPROVEMENT

The beginning of each course is an important time. Students felt faculty should clearly lay out the expectations for the course. They also recommended starting with diagnostic instruments the first day of class and the provision of sessions on mathematics and test anxiety.

Additional suggestions included mathematics laboratories, offering entering students developmental mathematics the summer before enrollment, and not changing the textbooks between MA 175, 275, and 375. A further idea was more "bonding" between instructor and students. They suggested assigning the same instructor in subsequent mathematics classes to achieve this mentor-mentee relationship found in the career fields. One student thought MA175 and 275 should be combined, but other students did not agree.

VIII. COMPLAINTS; WHAT IS NOT HELPFUL TO LEARNING

Upper level mathematics students complained that the calculus they learned was not used in either their engineering, architecture, or physics classes. Some engineering students felt they learned more mathematics from their engineering technology faculty than from mathematics instructors. Students said the first week of the course was often wasted because no work was assigned. They did not like faculty who urged students to drop a course and teachers who said problems were done "wrong," without explaining why. Students were very sensitive to being talked down to, being made to feel "stupid." A common gripe was teachers lecturing, "You should already know this." They felt tests should include more problems to increase likelihood of success, making them "fairer." High schools should also do a better job of preparing students for college mathematics. Particular pet gripes included instructors who confused which class they were teaching, and

a faculty member who daily assigned problems to be worked and then left the classroom for twenty minutes. Students felt mathematics should not be done just to get the right answer, but to learn how mathematics is applied in real life.

IX. VALUE OF STUDYING MATHEMATICS

The final question asked of each focus group was about the value of studying mathematics. Is mathematics useful? Does it aid problem-solving and logical thinking? Students were divided in their responses. Some saw no connection between mathematics and usefulness, while other students said mathematics definitely aided their problem-solving skills and helped them in their career area and with everyday problems.

X. CONCLUDING OBSERVATIONS

There are clear lessons for both faculty and students from the results of the student focus groups conducted by the Mathematics Task Force. Based on this valuable input from students, instructors wishing to enhance learning ought to engage in the following behaviors:

1) Come across as caring and supportive, making students feel comfortable in class from the very beginnning of the course
2) Avoid being perceived as "talking down" to students
3) Encourage students to ask any and all questions, even if repetitious
4) Involve students actively in learning, in such ways as writing on the chalk board and solving problems in class
5) Clearly explain each exercise step by step and indicate why each operation or part of the process is done and its purpose
6) Offer alternative means to solve problems
7) At the beginning of each course assess the needs of students in the class through utilization of pre-tests, diagnostic instruments, surveys, etc.
8) Be patient and present material at a pace the class is comfortable with
9) Provide real world examples and applications of all mathematical manipulations and types of problems, including applications in student career fields
10) Assign homework each week
11) Check and correct homework in timely fashion
12) Discuss student study habits and time management, including the necessity of studying mathematics at least five to six hours each week outside of class
13) Offer assistance to students facing "math phobia" and test anxiety
14) Encourage students to come to your office during office hours for assistance, and ensure that scheduled office hours meet the needs of the students in each course
15) Help students to form study groups.

16) Explain the value of mathematics, how foundational it is for modern science and technology, for logical thinking, and problem-solving.

Similarly, advice should be offered to all students who expect to succeed in mathematics courses. Students must understand that, regardless of how excellent the teaching, mastery of mathematics will result only from student effort. The following behavior by students will enhance likelihood of success:

1) Approach mathematics with confidence, openness, and enthusiasm
2) Pay close attention in class, taking notes on important material
3) Always ask questions of the instructor when material or explanations are not understood or unclear or confusing
4) If there is insufficient opportunity to ask all your questions in class, make an appointment to see the class instructor during his or her office hours. Know the scheduled office hours and location of the teacher's office
5) Be an active and engaged student, participating in class discussions
6) Do all assigned homework outside of class before it is due; practice reinforces learning
7) Plan to spend at least five to six hours per week outside of class studying mathematics (perhaps more hours prior to any scheduled test or examination). Budget your time to ensure these hours are set aside when you are fresh and not distracted
8) Help organize and participate in a student study group to review and learn mathematics material regularly
9) Visit the Learning Center for supplemental assistance in learning mathematics by using tutors and available software on the Learning Center computers
10) Read and study the course textbook and supplemental materials as assigned
11) Purchase available study guides and software and use to assist and supplement your studying
12) Strive for deep understanding of the material, not just doing problems to get the right answer. Understand why problems are solved the way they are. Seek practical applications and real life examples for the various types of problems studied.
13) Understand the value of mathematics in our society, how it teaches us logical thinking and problem solving and is the foundation for modern science and technology. Strive to use what you have learned in mathematics in career courses and in daily life
14) Attempt to take mathematics courses each semester as long as necessary.

REPORT OF SUBCOMMITTEE ON INTERDEPARTMENTAL MECHANISMS

Procedure

The subcommittee surveyed the Mathematics department and each department that the Mathematics department services with the following questions:

1. What are the current mechanisms for coordinating curricula between your department and the Mathematics department?

2. Can the existing mechanisms be improved and if so how?

3. How do you articulate with transfer institutions?

The surveys were conducted either by phone, personal meeting or written response, usually with the Chair but in some instances with a department member more familiar with the math courses. The summary of the results is attached.

Discussion of results

- No formal mechanisms exist for coordinating curricula between the Mathematics department and the departments it services. However 16 out of 23 departments feel there is no need for change and are satisfied with the present situation. Informal mechanisms consist of phone calls and discussions at meetings such as P&B, Divisional and College Council meetings. A somewhat regular dialogue does exist periodically at programming meetings between the Math department and its service departments.
- One uniform recommendation for change from five departments is that there should be regular meetings once a semester or once a year.
- Two departments charge their curriculum committees to address the Math department when concerns arise with math courses.
- In the Division of Technology, Prof. Kramer of the Mathematics department, under a joint agreement, teaches several courses in the Electro-Mechanical dept and maintains an office therein. As a result, he acts as an informal liason between the Mathematics department and the departments of Civil, Electrical, Electro-Mechanical and Mechanical technology with whom he maintains a good working relationship.
- The Mathematics department does utilize more formal procedures when new or changes in existing curricula or courses are being considered that affect other departments. Committees or representatives meet with with all departments involved and consider their needs and requests.

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REPORT OF SUBCOMMITTEE ON INTERDEPARTMENTAL MECHANISMS

- The third question in the survey falls somewhat outside the purview of this committee and was primarily for informational purposes. Articulation with transfer institutions varies with department and departmental needs.
- A department such as Art and Advertising must evaluate each student's work and portfolio individually to best assist in transfer to another school.
- A department such as Chemistry can rely mostly on CUNY certification as the students and graduates that transfer do mainly within CUNY. Concerning transfer within CUNY, guidelines do exist but are not usually followed.
- Some departments have secured effective transfer agreements as a result of concerted effort made by the department with a Dean or Chair of another institution such .as the Architecture department and Pratt Institute.

Conclusions

- The results clearly support little recommendation for change. However, in view of the fact that some departments would like regular meetings to evaluate math courses, the Mathematics Department should consider appointing a faculty member, perhaps a member of the curriculum committee, to act as a liason with each division. The liason can regularly meet with each department to discuss and evaluate the math offerings and make recommendations for changes.

Subcommittee Members
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SUMMARY OF SURVEY ON INTERDEPARTMENTAL MECHANISMS

Department	Highest Math	Coordinating Mechanism	Recommendations
Tech. Div			
Architecture	Ma 275	Informal	Little need for change
Civil	Ma 475	Informal with joint faculty liason	Regular meetings desirable
Electrical	Ma 475 (BT: Ma 675)	Informal with joint faculty liason	Little need for change
Electro-Mech	Ma 475 (BT: Ma 675)	Informal with joint faculty liason	Little need for change
Environmental	Ma 275	Informal	Little need for change
Mechanical	Ma 475	Informal with joint faculty liason	Little need for change
Lib Arts Div			
Chemistry	Ma 275 (BT: Ma 372)	Informal	Regular meetings desirable
Legal Studies	Ma 275 (BT: Ma 372)	Informal	Regular meetings desirable
Math	NA	Informal	Little need for change
Med Lab	Ma 275	None	Little need for change
Business Div			
Accounting	Ma 275 (Trans: Ma 375)	Informal	No change needed
Art & Adv	Ma 180	Informal	Regular meetings desirable
Computer Sys	Ma 275 (BT: Ma 375)	Informal	Regular meetings desirable
Graphic Arts	Ma 180 (BT: Ma 275, 250)	None but no special needs	No change needed
Hospit Mgmt	Ma 180 (BT: Ma 250)	Dept. comm. addresses if nec.	Improve course descriptions
Marketing	Ma 180 (Trans: Ma 275)	Informal through programming	No change needed
Office Tech	Ma 180	Informal	No change needed
Health Div			
Dental Hyg	Ma 180	Informal	Appoint dept. liason
Dental Lab	Ma 180 (Trans: Ma 275)	Informal	No change needed
Human Services	Ma 180	Dept. comm. addresses if nec.	No change needed
Nursing	Ma 180	Informal through programming	No change needed
Opthalmic Disp	Ma 275	Informal	No change needed
Radiologic Tech	Ma 275	Informal	No change needed

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